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Effect of special exercises using the mini trampoline on motor abilities and complex offensive skills in 14-16 years old handball players

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ABSTRACT

This study aimed to design special exercises using the mini trampoline for handball players aged 14–16 years and evaluate their effects on developing specific motor abilities and complex offensive skills in this age group. The experimental method was used, and a sample of 20 handball players, aged 14–16 years, was selected from specialized handball schools in Najaf province. The players represented the specialized handball schools affiliated with the General Directorate of Najaf province and the Kufa Sports Club Junior Handball School. The sample was equally divided into two groups: experimental and control. The motor abilities and complex offensive skills were determined as follows: motor abilities—eye and leg coordination, moving balance, and agility; basic offensive skills—passing and receiving, dribbling followed by shooting, receiving followed by shooting, and deception followed by shooting. The results indicated significant differences in the pre- and post-test measurements for both groups ($p<0.05$), except for the control group's balance measurement, which showed no significant changes ($p>0.05$). Players in the experimental group outperformed those in the control group in both motor abilities and offensive handball skills ($p<0.05$), highlighting the effectiveness of the trampoline exercises in improving overall performance. It is essential to incorporate training devices, including the mini trampoline, into training programs due to their effectiveness in developing motor skills, improving dexterity, and reducing effort and time.

KEYWORDS

Trampoline; Motor Abilities; Compound Offensive Skills; Handball

1. INTRODUCTION

Motor skills are among the most important aspects involved in the development of complex offensive skills. This is achieved through the use of modern methods and techniques in the education or training process, along with the preparation of appropriate exercises designed to enhance the performance of handball players. It is well-known that players progress through stages of development during the training process to acquire the skills required for performance within specified timeframes.

Countries worldwide focus on continuous development, particularly in the early stages of youth, by incorporating qualitative exercises that are engaging and utilize modern training methods and tools. Among these tools is the trampoline, a modern and exciting device characterized by its aesthetic appeal and precision, requiring coordinated movements in motor performance. The growing use of this tool in the modern era is highly significant in developing various physical and motor skills, blending excitement and engagement into exercises to achieve the highest possible level of performance during the game.

Modern training science primarily relies on employing specific training methods tailored to the age group, the nature of the game, its conditions, and its motor functions. The researcher believes that this approach can lead to a significant improvement in players' motor abilities, which will, in turn, enhance the performance of basic offensive skills in compound handball. These skills are among the most influential and widely utilized during the game.

Through the researcher's experience and observation of the exercises used with the age groups of the specialized schools, it is noticeable that they lack the use of modern tools for development in handball. There is difficulty in acquiring work-based motor skills, and this is fundamental for the basic offensive skills of complex handball. The exercises were limited to the use of classical methods or prevailing tools in the training process, and this does not allow for diversification and change. Since working with these groups needs fun and joy and not to repeat the same exercises prevalent in the training process, trampoline exercises were proposed and combined with motor skills, with the purpose of developing them along with the complex offensive skills. Handball is characterized by deception, shooting, passing, and receiving movements during performance, and all this needs high harmonic motor skills in order for the player to reach the best level of performance.

The current study aims to design special exercises using the mini trampoline for handball players aged 14–16 years and to evaluate their effects on developing specific motor abilities and complex offensive skills in this age group.

2. METHODS

2.1. Study design and participants

The experimental method was used with an equal group design, as it was suitable for the nature of the problem. The research community consisted of players aged 14–16 years from specialized schools for handball in the province of Najaf. The total population included 41 players, representing the specialized school affiliated with the General Directorate of the province of Najaf and the Kufa Sports Club for juniors. From this community, a sample of 20 players was selected, with 10 players from each school. These were equally divided into two groups: experimental and control.

2.1.1. Sample homogeneity

To verify the homogeneity of the sample, certain measures were taken to control the variables. The selected sample was of similar age to ensure consistency in the morphological characteristics of the participants. Table 1 illustrates the homogeneity of the research sample across the extraneous variables. The skewness values indicate that the data for each variable are approximately normally distributed, confirming the homogeneity of the sample.

Table 1. Homogeneity of the research sample in extraneous variables

Variables	Unit of measure	Mean	SD	Skewness
Length	Cm	165.666	3.314	0.030 -
Mass	Kg	57.583	2.645	0.016-
Age	Year	15.166	0.834	0.354 -
Training age	Year	3.083	1.676	0.017-

2.1.2. Equivalence of the two research groups

The results of Table 2 show that there were no significant differences between the experimental and control groups in the measurements of motor abilities and the performance of complex offensive skills before the implementation of the trampoline exercises ($p>0.05$), confirming the equivalence of the two groups.

Table 2. Equivalence between the two research groups (experimental and control)

Variables	Unit of measure	Control group		Experimental group		T value	*p*
		Mean	Std. deviation	Mean	Std. deviation		
Moving balance	Second	12.745	1.468	12.681	1.276	0.087	0.932
Agility	Second	29.56	1.61	29.38	0.99	0.436	0.669
Coordination	Second	8.975	0.64	8.860	0.60	-0.57	0.665
Passing and receiving	Number	21.571	1.718	21.285	1.112	0.369	0.718
Dribbling then shooting	Degree/time	0.053	0.029	0.054	0.020	0.105	0.918
Receiving and shooting	Degree/time	0.051	0.019	0.050	0.016	0.030	0.944
Deception then shooting	Degree/time	0.035	0.016	0.035	0.013	0.072	0.944

2.2. Determining key motor abilities and offensive skills

After reviewing relevant scientific literature and previous studies, the researcher created a questionnaire, which was then presented to a panel of experts in sports, training, and handball. The purpose was to gather their opinions on the most important motor abilities, complex offensive skills, and the appropriate tests for each motor ability and skill. After analyzing the responses and calculating the percentages, the motor abilities and complex offensive skills that received 75% or more were selected. The following outlines the results:

Motor abilities: Eye and leg coordination; Moving balance; Agility

Basic offensive skills: Passing and receiving; Dribbling, followed by shooting; Receiving, followed by shooting; Deception, followed by shooting

2.3. Tests used

The following tests were used to measure the identified motor abilities and offensive skills:

1. **Coordination:** Measuring the compatibility between the eyes and legs (Darwish, 2002).
2. **Balance:** Measuring moving balance on the bench (Hakim, 2004).
3. **Agility:** SIMO agility test (Darwish, 2002).
4. **Passing and receiving:** Measuring the speed of passing and receiving the ball (Al-Badri & Al-Sudani, 2011).

5. **Deception, shooting, receiving, shooting:** Tests from the author's handball quad (Ismail & Sobhi, 2019).

2.4. Experimental process

Two exploratory experiments were conducted on Friday and Saturday, 19–20/11/2021, involving a sample of 7 players who did not participate in the main experiment. The tests and some trampoline exercises were carried out in the pavilion of the Kufa Sports Club. The purpose of the exploratory experiments was to assess the validity of the playing field and the tools used, as well as their suitability for the tests. Additionally, the experiments aimed to identify potential challenges the researcher might face during the application of the exercises in the training sessions. The experiments also provided insights into the time required for each exercise, the number of repetitions, and helped establish the scientific basis for the tests, as shown in Table 3.

Table 3. Stability and objectivity coefficients of tests for motor abilities and complex offensive skills

N	Tests	Reliability coefficient	Objectivity coefficient
1	Coordination	0.86	0.96
2	Moving balance	0.90	0.98
3	Agility	0.87	0.97
4	Deception then shooting	0.88	0.95
5	Passing and receiving	0.91	0.97
6	Dribbling then shooting	0.88	0.94
7	Receiving and shooting	0.85	0.91

Regarding the main experiment procedures, pre-tests for both the control and experimental groups were conducted in the closed room of the Kufa Sports Club over two days. On the first day, motor skills tests were conducted on 11/23/2021, and on the second day, tests for offensive skills combined with handball were conducted on 11/24/2021.

Following the pre-tests, the experimental group participated in trampoline exercises from 11/26/2021 to 1/18/2022. This phase included 24 training sessions, held three times a week (Friday, Saturday, and Tuesday) over a period of 8 weeks. The exercises followed a progressive approach, starting from simple to complex and easy to difficult, and focused on both motor skills and compound offensive skills. The exercises were tailored to suit the research sample, with particular attention given to safety and protective factors.

After completing the exercises, post-tests were conducted over two days, on 1/21-22/2022, to gather and analyze the statistical results. To ensure consistency and accuracy, the researcher maintained

the same time conditions, location, equipment, and tools throughout the process to achieve the best possible results.

3. RESULTS AND DISCUSSION

Table 4 presents the differences between pre- and post-tests for the control and experimental groups in the research variables. The results indicate significant differences in the pre- and post-test measurements for both groups ($p<0.05$), except for the control group's balance measurement, which showed no significant change ($p>0.05$).

Table 4. The differences between pre- and post-tests for the control and experimental groups in the research variables

Variables	Group	Pre-test		Post-test		*p*
		Mean	Std. deviation	Mean	Std. deviation	
Moving balance	Control	12.745	1.468	11.846	1.265	>0.05
	Experimental	12.681	1.276	10.458	0.598	<0.05
Agility	Control	29.56	1.61	29.13	1.519	<0.05
	Experimental	29.38	0.99	27.050	0.822	<0.05
Coordination	Control	8.975	0.64	8.084	0.381	<0.05
	Experimental	8.860	0.60	7.650	0.492	<0.05
Passing and receiving	Control	21.571	1.718	23.362	0.871	<0.05
	Experimental	21.285	1.112	24.574	0.236	<0.05
Dribbling then shooting	Control	0.053	0.029	0.067	0.142	<0.05
	Experimental	0.054	0.020	0.071	0.036	<0.05
Receiving and shooting	Control	0.051	0.019	0.78	1.365	<0.05
	Experimental	0.050	0.016	0.089	0.478	<0.05
Deception then shooting	Control	0.035	0.016	0.055	1.001	<0.05
	Experimental	0.035	0.013	0.071	0.074	<0.05

As for the control group, the researcher attributes the difference in the variables to the nature of the exercises prepared by the trainer. This suggests that the approach had a positive effect on the post-tests, as it is grounded in scientific principles, in addition to the trainer's experience in this field. This aligns with Ghazi's (2008) study, which states that the use of drills should be consistent with the nature of their execution and the general approach to performing offensive and vehicular skills, as well as specialized motor skills, which lead to better results. He also agrees that complex skills aid in player preparation and performance. Thus, they serve two objectives simultaneously: developing kinesthetic ability and improving complex executions over time (Ibrahim, 1998). It is also evident from the above table that members of the control group did not achieve significant development in the level of balance measured during movement on the bench. The researchers believe this may be due to the fact that the

development program used by the coach did not include direct exercises to develop dynamic balance, and the coach did not use a trampoline to develop these skills.

As for the experimental group, the improvement is attributed to the effectiveness of the special exercises using the trampoline, developed by the researcher according to scientific principles. These exercises targeted the experimental sample and included kinetic skills paired with complex handball offensive skills. Additionally, the use of modern tools and equipment provided the field with motivation and enthusiasm for learning the skills. This is in line with what Ahmed Amin Fawzi referred to as "the diversity of tools and exercises, as all this excites the players and increases their motivation to progress and elevate their sporting level" (Fawzy, 2008, p. 20).

In the following, Table 5 shows the differences between the post-test results for the experimental and control groups in motor abilities and offensive skills in handball.

Table 5. Significance of the differences between the post-test results for the experimental and control groups in motor abilities and offensive skills in handball

Variables	**Unit of measure**	**Control group**		**Experimental group**		**T value**	***p***
		Mean	**Std. deviation**	**Mean**	**Std. deviation**		
Moving balance	second	11.846	1.265	10.458	0.598	6.166	0.000
Agility	second	29.13	1.519	27.050	0.822	5.396	0.001
Coordination	second	8.084	0.381	7.650	0.492	6.117	0.000
Passing and receiving	Number	23.362	0.871	24.574	0.236	3.548	0.003
Dribbling then shooting	Degree/time	0.067	0.142	0.071	0.036	6.412	0.002
Receiving and shooting	Degree/time	0.78	1.365	0.089	0.478	3.658	0.012
Deceit, then shooting	Degree/time	0.055	1.001	0.071	0.074	7.264	0.000

Upon examining Table 5, we observed significant differences between the two groups, with the experimental group showing better results ($p<0.05$). The researcher attributes this superiority to the use of the trampoline in the experimental group, compared to the control group, which trained using traditional methods. This suggests that incorporating fun and excitement into training positively impacts the players' motor skills and agility. The results of the post-tests reflect the players' improved performance, highlighting the importance of training methods tailored to the needs of handball.

Moreover, the variety of exercises, moving away from traditional routines, increased player motivation and excitement, which in turn enhanced their preparedness. The more players practiced and repeated exercises, the greater their improvement in motor skills, balance, agility, and coordination.

The researcher believes that the difference between the two groups can be attributed to the nature of the exercises used in the training units, particularly the mini-trampoline, which was part of the experimental group's regimen. The exercises involved various postures, precise repetitions tailored to each player's capacity, and ongoing corrections by the coach to address any motor execution errors. Furthermore, the encouragement and motivation provided throughout the preparation period contributed to improved performance, especially in accuracy, balance, coordination, deception, and handling skills. This was confirmed by the significant differences observed in the experimental group compared to the control group. The positive role of tools and aids in enhancing performance accuracy, particularly through the use of the trampoline, is supported by Abdul Razzaq (1999), who states that the use of various educational and training aids in training processes makes learning more effective and positive.

4. CONCLUSIONS

The trampoline exercises positively impacted the development of motor abilities and complex offensive skills in handball. The improvement in motor abilities was directly reflected in the enhanced performance of the research participants' complex offensive skills. Players in the experimental group outperformed those in the control group in both motor abilities and offensive handball skills, highlighting the effectiveness of the trampoline exercises in improving overall performance.

5. RECOMMENDATIONS

It is essential to incorporate training devices, including the mini trampoline, into training programs due to their effectiveness in developing motor skills, improving dexterity, and reducing effort and time. Handball coaches should be encouraged to ensure that the duration of exercises with modern devices aligns with match conditions and closely resembles performance on the playing field. Additionally, further scientific research should be conducted using different methods and devices across various samples and sports to explore their effectiveness in enhancing athletic performance.

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AUTHOR CONTRIBUTIONS

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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